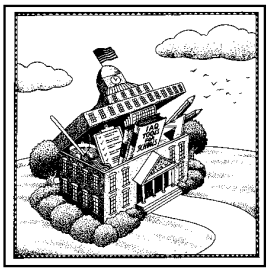
United States Environmental Protection Agency
Indoor Environments Division
Office of Radiation and Indoor Air
6609J
EPA-402-F-00-010B
August 2000

CASE STUDY

WILLIAM BLACKSTONE ELEMENTARY SCHOOL

Boston Public Schools, Massachusetts

Indoor Air Quality



Tools for Schools

William Blackstone Elementary School, located in Boston's South End, is part of the Boston Public Schools system. Of the 120 schools in the system, three were chosen to implement EPA's *Indoor Air Quality Tools for Schools (IAQ TfS)* Kit and program. Of these three schools, Blackstone Elementary was the first to do so.

"Every school has a Healthy Schools Team dedicated to making their school safer and healthier. We received some great press from implementing the Kit—the local newspapers wrote several articles about our Healthy Schools Team."

-Robin Chappell
District Health Official

Approach—Project Description

School Description

The five-story school building was constructed in 1975 using the typical design of that time—brick walls, mostly flat roofs, plexiglass windows, and visible duct work. For years, indoor air quality (IAQ) was an issue at Blackstone Elementary. The school nurse noticed that the asthma rate was higher than the national average of two cases per classroom. Staff were also aware of serious problems with water intrusion during heavy rains, stained and collapsed ceiling tiles, peeling paint and stains on the walls, rust on support beams, and water damage to equipment and furniture.

IAQ Team

In January 1999, the IAQ Team at Blackstone Elementary was the most prepared to meet regularly to implement the program. The school's IAQ team met six times from January to June 1999, using the *IAQ TfS* Kit as the basis of their discussions. The Blackstone team consisted of school district officials, the school principal, the school nurse, teachers, parents, custodians, and EPA regional staff.

The IAQ team and a ventilation engineer from the Boston Public Schools system conducted a walkthrough inspection of practically every area of the school. School staff were given the appropriate documents from the Kit, including checklists covering all areas of the building. About 80 percent of the checklists were returned.

Problem Identification

Problems identified by the checklists and walkthrough included the following:

- An above-average number of asthma cases and illnesses typically associated with indoor air quality problems (headaches, nausea, etc.).
- Water damage, such as mold and mildew; missing, stained, and broken ceiling tiles; fungal growth on ceiling tiles; and damaged ceiling and wall plaster.
- Thermal discomfort, such as widely fluctuating temperatures, too high or too low humidity levels, and cold drafts.
- Ventilation problems, such as poor air circulation and lack of exhaust fans in some bathrooms.
- Cleanliness problems, such as dust accumulation around the supply vents and surrounding ceiling tiles, infrequent dusting and vacuuming, and pest problems.

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WILLIAM BLACKSTONE ELEMENTARY SCHOOL

Boston Public Schools, Massachusetts

EPA's IAQ TfS Kit gave the team the leverage it needed to persuade the school district to improve the environmental problems in the school.

Lessons Learned

Short-term Improvements

Based on the information found in the walkthrough, the IAQ team brainstormed and identified specific solutions for improving the indoor air quality at Blackstone Elementary School. In addition, EPA's *IAQ TfS* Kit gave the team the leverage it needed to persuade the school district to improve the environmental problems in the school. Once the Superintendent was informed of the school's IAQ issues and the team's recommendations, Blackstone Elementary was placed on a high-priority list for roof repairs and other renovations.

A number of improvement projects have been completed, including roof repairs during the summer of 1999. Current plans call for installing new energy-efficient lighting and new ceiling tiles. Additionally, carpeting will be removed and replaced with tiles in some classrooms. The school nurse intends to document student health and asthma cases over the next year to establish a link between the indoor environment and children's health.

Long-term Practices and Policies

Blackstone Elementary is now in its second year of *IAQ TfS* implementation and hopes to collect information on the improved health of students and staff. Much of the credit for the school's progress rests with the principal, Ms. Ruiz-Allen, who took over the project after the first meeting and welcomed all ideas. She was instrumental in getting the Superintendent involved and ensuring that the repairs were done quickly. The presence of officials from EPA Region 1, the Boston Public Health Commission, and Boston Public Schools at the meetings also proved key in Blackstone's success, as these groups created a strong sense of purpose and assured the team that their IAQ problems were not impossible to fix.

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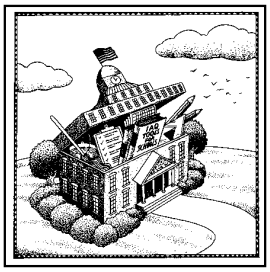
CASE STUDY

KING-MURPHY ELEMENTARY SCHOOL

Clear Creek School District, Colorado

Indoor Air Quality



Tools for Schools

King-Murphy Elementary School, part of the Clear Creek School District, is located in Evergreen, Colorado, about 30 miles west of Denver. Two hundred and fifty students in grades K through 6 attend the school.

Approach—Project Description

School Description

The two-story King-Murphy Elementary School was built in 1982, using a passive solar design. The heating, ventilating, and cooling (HVAC) system consists of unit ventilators and five new rooftop units for heating and cooling the second-floor classrooms.

Prior to the indoor air quality (IAQ) campaign at King-Murphy, the school district hired a new Facilities and Maintenance Director. He negotiated a performance contract with an energy service provider, who would design a plan, install energy-efficiency technologies, and guarantee their performance. The contract covered upgrading the school's HVAC system and installing a district-wide energy management system (EMS). District staff knew that IAQ problems existed in some of their schools and were committed to considering the effects of energy efficiency upgrades on IAQ as the upgrades were planned and implemented.

"The IAQ TfS Kit prompted us to track our student health problems, like asthma and allergies, and try to relate them to our past IAQ improvements. We've really been noticing the number of student absences decreasing since the IAQ improvements were initiated."

-Art Benton
Facilities and Maintenance Supervisor

IAQ Team

The school formed an *IAQ Tools for Schools (TfS)* steering committee in October 1998, led by the principal and the custodian. The team also included the District Facility Maintenance Supervisor, a teacher, a student from the Environmental Science Club, and a parent. They developed a 5-month plan for implementing *IAQ TfS*.

Problem Identification

The first IAQ meetings revealed very real concerns, including hazardous waste removal and management, exhaust fumes in the building, irregular filter replacement schedules, general inadequacy of the air-handling system, and overheating from the south-facing clerestory windows. The potential for radon gas was also a concern because the school is located near mountains containing old coal mines. Seepage of the radon gas from these mines was an issue not to be overlooked. All concerns were ultimately addressed by implementing *IAQ TfS*.

The teachers completed their IAQ checklists in December, and the head custodian and principal coordinated completion of the remaining lists. Then the team reviewed the checklists and prepared for a walkthrough. The walkthrough consisted of one-on-one interviews with teachers who had identified specific concerns, and visual inspection of certain areas of the school with identified or potential problems. Staff measured and recorded carbon dioxide (CO_2) levels and room temperatures, along with any observations and interview information, on a spreadsheet.

The walkthrough revealed that diesel fumes from idling buses entered several rooms on the south side of the building through the unit ventilators. The team also noted that the outside air dampers were set to allow air in only when the temperature is above 40° F to prevent freezing coils, thus leaving classrooms without adequate outside air during most of the heating season. Radon testing showed low radon levels (below EPA's action level) throughout the school.

Although many IAQ issues were identified, the team was aware of concerns about the impact of the new program on the maintenance staff's workload, as they were already very busy. The Facilities Director addressed these concerns and also assured the maintenance staff that the IAQ issues and operational changes identified were not a critique of their performance. The IAQ work at the elementary school commenced soon after.

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KING-MURPHY ELEMENTARY SCHOOL

Clear Creek School District, Colorado

"I got a lot more out of IAQ Tools for Schools than I anticipated. The program has really helped us because we are addressing things that needed to be fixed and we can take this to other schools [in our district]."

–Art Benton Facilities and Maintenance Supervisor

Lessons Learned

Short-term Solutions

As a result of the walkthrough in January 1999, the team developed a set of IAQ policies for King-Murphy Elementary School. Staff are advised to do the following:

- Keep unit ventilators clear of books, papers, and other items.
- Maintain the temperature between 68º and 72º F.
- Keep warm-blooded pets out of classrooms or, when they visit, limit time of exposure and ensure good ventilation.
- Be aware of the cleaning schedule and expectations for keeping horizontal surfaces clean.

Staff are also encouraged to know the proper procedures for storing and discarding chemicals. Material Safety Data Sheets on the chemicals will be kept on file and updated whenever necessary. The district sought a waiver from Health and Human Services to use a bleach alternative for weekly cleaning, and that has become the rule. The policies were communicated to all staff and included in the new-teacher and beginning-of-year information packets.

The school also worked with its energy service provider to address IAQ problems related to the HVAC system. The contractor adjusted the outside air dampers and added glycol to the water pipes to increase the amount of outside air during the heating season. Timers were installed to shut off the outside air supply during the 15-20 minutes the buses are loading. This will prevent diesel fumes from entering classrooms on the south side of the building through the unit ventilators. The school arranged to install tinted clerestory windows to reduce overheating in upstairs classrooms. Plans were also made to replace metal air filters with pleated paper filters, which are up to 80-percent efficient. The school's preventive maintenance plan specifies that the filters are to be replaced every 90 days.

The IAQ team members noticed a dramatic improvement in their comfort levels and a decrease in IAQ-related complaints between the first and last scheduled IAQ meetings.

Long-term Practices and Policies

Implementing the *IAQ TfS* Kit was a positive learning experience for the Clear Creek School District. Participants agreed that the onsite involvement of knowledgeable staff from EPA's regional office was key to the successful implementation of the Kit at King-Murphy Elementary School. As a direct result of implementing the *TfS* Kit, the district is now establishing hazardous waste training sessions for all staff members. One year ago such programs were not considered necessary, but the success of the *IAQ TfS* Kit helped pave the way for new environmental issues to be addressed.

District staff are making *TfS* a learning experience for students, too. From the very beginning, the Superintendent requested that the students be included as much as possible. King-Murphy students helped complete checklists, collected particulate samples, and wrote about what they learned. IAQ provided an opportunity for students to get involved in their own education and increase their awareness of the indoor environment.

In a new program beginning September 2000, Art Benton, Facilities and Maintenance Supervisor, is establishing an internship for high school students from the district. They will review the recorded sick days of students and staff from all district schools that implemented the *IAQ TfS* Kit and record the reason for the sick day—whether it can be attributed to asthma, allergies, flu, or simply missing the bus. Also in September, Georgetown Elementary School will begin to participate in the *IAQ TfS* program.

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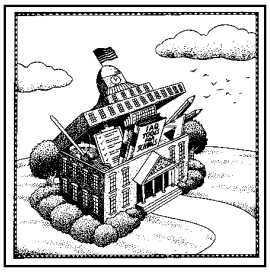
CASE STUDY

G.W. CARVER AND CHARLES DREW ELEMENTARY SCHOOLS

San Francisco Unified School District, California

Indoor Air Quality



Tools for Schools

G.W. Carver Elementary School, part of the San Francisco Unified School District (SFUSD), is located in the Bayview/Hunters Point community, a suburb of San Francisco near 3-COM Park. In early 1998, the principal at Carver Elementary was overwhelmed by the number of students coming to the main office for their asthma inhalers. The principal expressed her concern about the children's health to a friend working with Kaiser Permanente. As it happened, Kaiser, the American Lung Association (ALA), and the State of California were well aware that people living in San Francisco's Bayview/Hunters Point community had a much higher incidence of asthma and other respiratory illnesses than those living in other parts of the city. Carver Elementary was of particular concern because its students were reporting an even higher rate of asthma cases than at a nearby school.

Approach—Project Description

Getting Started

Through its *Open Airways* program, ALA was already working with the school nurse from Carver to provide asthma training courses. In March 1998, ALA hosted a roundtable discussion focusing on indoor air quality (IAQ). The event was well-publicized. Attendees included representatives of the Environmental Protection Agency (EPA), ALA, Kaiser Permanente, SFUSD staff including the Deputy Superintendent and the District's Facilities Manager, and others. Their discussion centered on the high asthma rates and kicked off a planning effort for assessing, prioritizing, and remedying IAQ problems in schools.

During the discussion, EPA offered technical assistance to SFUSD schools that would commit to pilot testing EPA's *Indoor Air Quality Tools for Schools (IAQ TfS)* Kit and program. Two schools were chosen as pilots, G.W. Carver and Charles Drew elementary schools, both of which were built in 1974. Carver has approximately 390 students in grades K-5, while Drew has approximately 240 in the same grades. The same nurse serves both schools.

"As a school nurse, I can see from a medical standpoint how important good IAQ is to schools, but I have gotten a tremendous amount of education from using this Kit; especially from the walkthroughs."

- Marie Hoemke School Nurse

IAQ Team

Following the recommendation in the *IAQ TfS* Kit, the two schools established a joint IAQ team. The team includes the school nurse (who is also the IAQ Coordinator), the facilities manager, maintenance supervisors, custodial supervisors, planners, architects, and representatives from the District's health program.

Problem Identification

EPA brought in an IAQ expert to conduct scientific analyses at the two schools, using state-of-the-art monitors/meters and walkthroughs to evaluate building performance and ventilation. Administrators, teachers, and custodians participated in the first walkthrough. Facilities Management staff participated in a second walkthrough that focused on the more technical aspects of the facilities.

The first walkthrough provided the team with the necessary training to implement the school district's new IAQ Policy, which is centered around the *IAQ TfS* Kit. They learned that various, and sometimes seemingly inconsequential, factors can combine to affect IAQ. For example, the ventilation system at one of the schools had been inadvertently shut off. Although they noticed the warm temperature, school staff were unaware that the system was not operating, and the problem went unreported. A timer, set to turn the ventilation system on and off each day, had been overridden due to miscommunication. A short discussion with the custodial staff remedied a long-standing problem. Other IAQ problems identified during the walkthroughs were addressed, and measures to control IAQ became a part of the schools' normal maintenance practices.

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Lessons Learned

Visits to the nurse's office for inhaler use have dropped by at least half.

Short-term Results

Staff at both schools made low-cost improvements that provided immediate IAQ benefits—better learning and teaching conditions for the students and faculty without unduly taxing the district facilities staff. The health impact was almost immediate. In February 1999, the SFUSD School Health Programs Department reported, "We are already noting some positive effects from the building maintenance that resulted from the walkthroughs." Some observations worth noting include:

- Visits to the office for the use of asthma inhalers were reduced by half.
- Fewer students keep asthma medicines/inhalers at school, and asthma episodes are less frequent even though the number of students with asthma has not changed.
- Airflow throughout the schools has been greatly improved.

Long-term Practices and Policies

Teachers and staff participate in the IAQ process by completing the *TfS* checklists on a regular basis, which helps school and district staff keep up with IAQ issues as they arise. The IAQ roundtable and the success of the two *IAQ TfS* pilot schools have had a positive, noticeable effect on SFUSD and the community at large. As a result,

- The Superintendent, with the support of EPA, agreed to author an **IAQ Policy** for SFUSD, based on the *IAQ TfS* Kit.
- SFUSD is currently implementing the same measures in 16 more schools, 8 of which have already had IAQ training and walkthroughs. Other schools in the district have attended the training and are anxious to be involved. A new group of schools is being formed for next year.
- Interest in IAQ among community members has skyrocketed. Today, more than 40 people regularly attend meetings to discuss IAQ issues and their potential health effects.
- An **Asthma Task Force** has been established involving school officials, EPA, ALA, University of California at San Francisco Medical Center, Stanford University, and the San Francisco City Health Department. The task force will provide resources to the public, including a telephone hotline and directory of resources.
- An **Implementation Committee**, formed by the school nurse/IAQ Coordinator and a member of the teacher's union, has been established to ensure that (1) the goals set forth at the roundtable and the IAQ problems found during the walkthrough are addressed, and (2) schools follow the IAQ Policy.
- A phone number is now available to school district staff to call for immediate response to IAQ problems (real or potential) such as odors and mold growth.
- The district established an **Integrated Pest Management (IPM)** program, committing to use non-toxic/least toxic methods of pest control.
- The San Francisco Health Department established the **Children's Environmental Health Department**. Staff, including industrial hygienists and nurses, will assess schools, homes, and other buildings for IAQ issues.
- The Mayor's office funded the development of the **Health and Environmental Resource Center**. The Center, which is now also supported by funds donated by the San Francisco (City and County) Board of Supervisors, holds evening training classes and will also train in schools, day care centers, and other sites about asthma and cancer. The Center, along with the Children's Environmental Health Department, is currently developing a partnership with local health care providers.

Direct involvement and support of SFUSD's Superintendent, Deputy Superintendent, and Facilities Manager have been and will continue to be key to the success of the IAQ program throughout the San Francisco Unified School District. The support of EPA, ALA, the City Health Department, and others is also important.

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